New Jersey Atlantic white cedar Decline

USDA Forest Service Diagnostic Trip Report

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Atlantic white cedar (AWC) (*Chamaecyparis thyoides*) occurs along the Atlantic coast from Maine to Florida and continues along the gulf shore to Mississippi. Being a coastal species it usually is not found more than 130 miles inland. It is a most durable tree withstanding temperature extremes, acidic soils with minimal available nutrients, heart rot decay, and most diseases and insect pests. Since colonial times this tree has been utilized for numerous outdoor building applications requiring wood highly resistant to warping, shrinkage, and decay. Shingles made from New Jersey AWC were used extensively in New York City and Philadelphia for roofs in the 1800's. Today, AWC milled wood products are still used for many outdoor applications such as decks, shingles, siding, and outdoor furniture. Interestingly, Independence Hall in Philadelphia still uses New Jersey AWC shingles as roofing material.

As a primary eastern swamp colonizer, the tree protects stream and river beds form soil erosion, controls and retains flood waters, filters and absorbs pollutants and stores water during drought conditions. Besides maintaining swamp land watershed structure, the Atlantic white cedar forest also provides habitat for many indigenous and unique wetland species of plants, birds, reptiles, and insects.

Since colonial times, New Jersey has experienced a significant decrease in AWC acres mostly in the Pine Barrens region. Prior heavy removal without restoration, clearing swamp areas for agriculture, and more recent inadequate management practices, illegal harvesting, wildfire, and dear browsing, have combined to decrease AWC forests from approximately 115,000 original acres present during colonial times to only 30,000 acres today. To a lesser degree certain natural maladies also contributed and may still be contributing to the decreased numbers of this tree. Beaver dams, salt water intrusion, infiltration of pollutants both industrial and agricultural from outlying areas all present imminent treats to the AWC ecosystem. It is the goal of the NJ Forest Service to maintain these remaining acres as AWC sites and further increase the abundance of AWC on other state lands utilizing seedlings grown at the New Jersey State Nursery. Unfortunately, a debilitating tree problem presently occurs within several AWC forested areas.

Since 2004 NJ Forest Service personal have observed unexplained Atlantic white-cedar decline and mortality in several southern areas of the state. I initially observed this problem in 2004 with Jon Klischies (NJ Forest Service), Bob Acciavatti (USFS), George Zimmerman (Concord College), and Bob Williams (NJ Forestry Consultant) visiting three declining AWC sites within the New Jersey Pine Barrens. One site appeared to be affected by salt water intrusion and the other possibly by chemical drainage from a nearby landscape nursery. However, decline on the third site, located within the Parvin State Forest, could not be attributed to any obvious abiotic disorder. Several trees had discolored canopies with thinning crowns. Others scattered throughout this site were in various states of decline. Various bark/sapwood colonizing fungi were observed but were considered secondary fungi or opportunistic colonizers of stressed tree. Decay and canker fungi were not observed except for one tree (Fig. A). This tree had apparent lower stem sapwood discoloration possibly caused by a soil pathogen with clear evidence of mycelial fans and rhizomorphs associated with an *Armillaria* species fungus. We considered this fungus a secondary colonizer possibly colonizing a tree stressed by a soil pathogen. A few moribund or dead trees were associated with a cedar bark beetle (*Phloeosinus* spp. Fig. B) that also appeared to play a secondary role not being associated with trees in less decline. A definitive diagnostic could not be made at this time and the USFS was not involved further on this project until most recently.

Fig. A. Lower stem sapwood discoloration possibly caused by a root pathogen with *Armillaria* associated mycelial fans and rhizomorphs both on sapwood and inner bark.

Fig. B. Only highly stressed or dead trees could be associated with a cedar bark beetle (*Phloeosinus* spp.)

This year, the USFS MFO received information that AWC decline was increasing within the New Jersey Pine Barrens since 1984. Purportedly new areas with significant mortality are being observed. I spoke with Jon Klichies and Bob Williams concerning these new and escalating decline areas. I asked Jon and Bob to locate AWC decline sites associated with both declining and moribund trees. On March 6, I visited one of these sites joined by Bob, Karen Felton (USFS), Bill Oldland (USFS), Yilmaz Balci (University of Maryland), and George Zimmerman, to investigate a cedar swamp site located within the New Jersey Pine Barrens.

Bob reiterated that the decline site was typical of others in other Pine Barren areas. Traversing through the swamp we noted many healthy appearing AWC. However, we eventually came upon the decline area and immediately observed numerous dead trees and others with sparse, discolored canopies. Dieback associated with these trees was extensive and a stark contrast to adjacent healthy areas (Fig.C). The site appeared unusually circular and

nearly 200 feet in diameter. Soil conditions appeared similar to surrounding healthy areas typical of swamps.

Fig. C. Within the AWC decline stand. Trees in the foreground have extensive dieback and several trees are dead. Healthy trees with full crowns can be seen in the background.

We examined tree stems and boles for insect activity and occurrence of fungal cankers and fruiting bodies. Most biotic activity appeared to be secondary or opportunistic as organisms establishing after initiation of the decline and only on severely declined or dead trees. Trees in less severe decline showed no signs of insect or fungal activity. However, bark flaps removed from lateral roots on a limited number of select trees revealed extensive discoloration into the sapwood. Even though limited in scope at this time, this finding suggests involvement of a soil pathogen. Additionally, a limited number of root excavations within the decline area showed absorption roots with poorly developed and few root hairs. Few and poorly formed mycorrhizae could be observed as well. Both these observations additionally suggest possible involvement of a soil borne pathogen. Several soil samples were taken form the decline area and were processed at the University of Maryland Plant Pathology Laboratory.

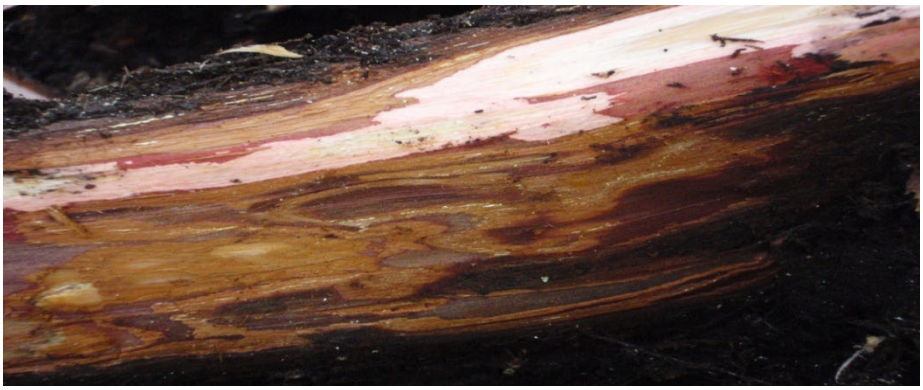

Fig.D. Large AWC lateral root with several necrotic lesions.

Individual samples consisted of soil being collected below the organic layer and from four discreet areas around declining trees. All samples proved positive for a *Phytophthora* species soil pathogen. To date, using both cultural and molecular techniques, species confirmation is not definitive. Interestingly, a positive identification to species (*P. cinnamomi*) was made using molecular techniques. However, in pure culture the rate of growth and morphology of this fungus is dissimilar to those historically described for this species. Furthermore, growth and morphology characteristics appear to be unique to this species when compared to other identifiable *Phytophthora* species. Dr. Yilmaz Balci at this time suggests the possibility of a new species or sub-species.

Additional soil samples from the decline area were needed to firmly establish the presence of the suspect pathogenic fungus. In addition, Yilmaz and I decided that soils also should be collected in areas remote from the decline site with healthy appearing AWC. This would provide important information as to the relevance and role of the isolated fungus. For example, finding the fungus only in the decline area might suggest more of a primary pathogen. Finding the fungus in both healthy and decline areas might suggest the fungus acting in a more secondary pathogenic role, or perhaps having no role at all in the decline syndrome.

On April 19 I made a second visit accompanied this time by Jim Haase, Bill Zipse, and Courtney Compton (all New Jersey Forest Service personal) along with Bob Williams again. Soil samples were obtained from both decline and healthy areas and are presently being processed and analyzed at the University of Maryland Pathology Lab. Yilmaz and I also decided to obtain 50 AWC seedlings from the NJ State Nursery located in Jackson, NJ. These seedlings are presently being grown at the University of Maryland pathology greenhouse. Once established, varying spore suspensions of the suspect decline fungus will be applied to roots. This might provide information as to the pathogenicity of this fungus. Equally important, this also will provide valuable information to the NJ Forestry AWC re-forestation program using similar nursery grown seedlings for re-planting purposes. Finally, during this visit the entire decline site

was delineated with tree marking paint. If confirmed to be a pathogen unique to the decline area, the rate of disease spread into adjacent soils with healthy AWC can be more precisely monitored.

Bob Williams and New Jersey Forest personnel are presently locating other sites with similar conditions within the New Jersey Pine Barrens. It is important to continue to develop and establish survey and study protocols for the present field, laboratory, and seedling inoculation work. Methods can be used to describe other AWC decline areas.

Fig. E. Karen Felton (Biologist) and Bill Oldland (Entomologist) demonstrating the proper technique to help save the Atlantic white cedar. But how many trees can they hug?